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A Study of Gross Terms of Trade and Exchange Rate in India Since 2010

ORIGINAL ARTICLE

Author
Mukund Kumar
Research Scholar
Departpart of Economics
Patna University
Patna, Bihar, INDIA

Abstract

This paper examines correlation and impact between the Gross terms of trade and the exchange rate. This study is completely based on time series data since 2010 to 2022. The statistical (Correlation and Descriptive Statistics) and econometrical(Unit root test, Cointegration and VECM)tools are used to analysis of data. The paper found that both variables are positively correlated and cointegrated in the long run. However the impact is not significant between variables. The Granger Causality shows that there is unidirectional relation between the variables. VECM also explain the speed of adjustment is 19 percent in the long run.

Key Words

Gross terms of trade, Exchange rate, Correlation, Unit root test, VECM.

Introduction

In the dynamic world, terms of trade is a barometer of economic health of country. Terms of trade refers to the ratio between the country's export price and import price. The measurement of terms of trade is recorded in an index number. The terms of trade index is explained as the value of total export minus total import of an economy. The economist G.M. Meier has classified several concepts of terms of trade in to three broad categories:

1. Classification on the basis of ratio of international exchange between commodities: this type has also been classified into three different terms of trade –
   a) Net barter terms of trade.
   b) Gross barter terms of trade.
   c) Income terms of trade.
2. Classification on the basis of changes in factor productivity: it has also two types of terms of trade –
   a) Single Factoral terms of trade.
   b) Double Factoral terms of trade.
3. Classification on the basis of utility analysis: on this basis there are two concepts of terms of trade-
   a) Real cost terms of trade.
   b) Utility terms of trade.

As mentioned classification of terms of trade, the ratio of international exchange between commodities is important type and its' one of the section is gross barter terms of trade .this paper only study the gross terms

of trade and the exchange rate relation.

The gross terms of trade is a ratio of total physical quantities of imports to the total physical quantities of exports of the economy. The gross terms of trade in case of particular commodities is measured at a particular point of time with the help of given formula:

$$T_G = (Q_M \div Q_X) \times 100$$

Where T_G is gross terms of trade, Q_M is aggregate quantity of imports and Q_X is the aggregates quantity of exports. If higher the index value of T_G over 100, better are the gross terms of trade. It means the country can imports larger quantity from abroad for the given quantities exported to others, whereas if the value of index is less than 100, it means the gross terms of trade are not favourable to the country and it can import smaller quantities of goods from abroad for the same quantity of exports.

The exchange rate is a rate at which one currency will be exchanged with another currency and affects the trade and flow of money between the countries. The exchange rate generally explains in two ways first one is fixed or pegged exchange rate, which means Government or monetary authority fixed the value of the currency in terms of another currency, whereas second one refers the floating or flexible exchange rate, which means currency value is determined by the supply and demand of money in the market, this system doesn't consider the Government intervension. While in recent period every economy adopts the Managed floating exchange rate system. In this system the value of currency is decided by market mechanism and Government interference (if there is instability in the countries). So we can say this system is a combined form of both fixed and flexible exchange rate.

Review of Literature

Tary and Yyldyrym (2009) explored the connection between fluctuations in foreign exchange rates and export volumes. They employed variables such as real exports, comparative price index, real foreign exchange rate, and real foreign exchange rate uncertainty in their analysis. The findings indicated that, contrary to short-term expectations, foreign exchange rate uncertainty did not impact export volumes; however, in the long term, it was associated with a negative effect on export volumes, as asserted by the research

Ata and Arslan (2003) utilized yearly data spanning from 1980 to 2000, conducting both cointegration analysis and a Granger causality test. The outcome of their research revealed the presence of both direct and indirect causality links between the foreign exchange rate and the volume of foreign trade in Turkey.

Hepaktan et al. (2011) examined the correlation between real foreign exchange rates and foreign trade in the Turkish economy, utilizing monthly data spanning from 1982 to 2011. Their investigation involved the application of Johansen cointegration and Granger causality tests. The findings from their study suggested that implementing foreign exchange rate policies was ineffective in sustaining foreign trade balances.

Campa and Goldberg (2005), this paper examines overall UK imports with the OECD and calculated the exchange rate pass-through for overall UK imports to be approximately 0.4 in both the short and long term. Despite being relatively lower than the mean values for OECD countries in the study (0.61 in the short run and 0.77 in the long run), this signifies that there is only partial exchange rate pass-through.

Objective of the Study

1. To explain the relation between the exchange rate and Gross terms of trade during study period.

Hypothesis of the Study

1. There is no relationship between exchange rate and Gross terms of trade.
2. There is an impact of exchange rate on Gross terms of trade.

Research Methodology of the Study

This research is based on the secondary data, which is taken from RBI site in the Handbook of Statistics on Indian economy. this paper analysis the time series data from 2010 to 2022. The data is analyzed with appropriate Statistical and Econometrical tools like Correlation, Descriptive statistics, Unit root test, Johnson Cointegration, VECM and Granger Causality. This data is analyzed though EViews 12 Student Version lite.

Empirical Analysis of the Study

Trend of Exchange Rate and Gross Terms of Trade

The table given below shows the exchange rate and Gross terms of trade (TOT) of India from 2010 to 2022. Rupees exchanged in terms of dollar and Gross TOT represented in index form with base year 2012-13.

Table 1

Year	Exchange Rate (Rupees per dollar)	Gross TOT
2010	45.72	102.3
2011	46.67	74.3
2012	53.43	73.1
2013	58.59	67.5
2014	61.01	66.9
2015	64.15	60.0
2016	67.19	50.0
2017	65.12	61.6
2018	68.38	101.3
2019	70.42	86.0
2020	74.09	92.0
2021	73.91	68.9
2022	78.6	100.5

*(**Source:** RBI, The Handbook of Statistic in Indian economy)*

The combined graph of the exchange rate and the terms of trade, which shows the trend of the variables since 2010 to 2022, upper curves shows GrossTOT and lower one is exchange rate.

Descriptive Statistic

Table 2

	Gross TOT	Exchange rate
Mean	77.26154	63.63692
Median	73.10000	65.12000
Maximum	102.3000	78.60000
Minimum	50.00000	45.72000
Std. Dev.	17.37688	10.27836
Skewness	0.232012	-0.463494
Kurtosis	1.780990	2.212027
Jarque-Bera	0.921540	0.801779
Probability	0.630798	0.669724
Sum	1004.400	827.2800
Sum Sq. Dev.	3623.471	1267.737
Observations	13	13

Descriptive Statistic shows that the average exchange rate is 63.63, minimum is 45.2 and maximum exchange rate is 78.6 during the study period standard deviation shows the deviation from the average of exchange rate, which is 10.27. As per the measures of Normality that is indicated by Skewness and Kurtosis. So Skewness shows the degree of symmetry, as per the value of exchange rate is .-0.46, which is less than 0,it means data is negatively skewed. However, Kurtosis measures the Flatness or peakness of the distribution of the series. As per the exchange rate kurtosis is 2.21, which is less than 3. Its curve is platykurtic.

The average Gross TOT 77.26, minimum is 50 and maximum Gross TOT is 102.3 during the study period standard deviation, which is 117.37. As per the measures of Normality that is indicated by Skewness and Kurtosis. So Skewness shows the degree of symmetry, as per the value of Gross terms of trade is .0.23, which is greater than 0, it means data is positively skewed. However, Kurtosis measures the Flatness or peakness of the distribution of the series. As per the Gross TOT kurtosis is 1.78, which is less than 3. Its curve is platykurtic.

Correlation

There is a positive correlation between the exchange rate and the Gross terms of trade, which value is 0.08. it means the correlation is positively weak.

Econometrical Analysis

As the collected data of the study is based on time series, so Firstly we shall check the stationarity of the variables with the help of the Unit Root Test, and then we will apply appropriate econometrical tools. Here unit root test is done by Augmented Dicky- Fuller test.

Unit root Test of the Exchange Rate

As per the Augmented Dickey-Fuller test analysis, the exchange rate is non-stationary at the level but stationary at 1st difference.

Table 3

Null Hypothesis: D(EXCHANGE_RATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.627129	0.0246
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	

The above table shows that the probability value is 0.02, which is less than 0.05 level of significance, it means we reject the null hypothesis and the data is stationary at 1st difference.

Unit Root Test of Gross TOT

Table 4

Null Hypothesis: D(GROSS_TOT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on AIC, maxlag=1)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.946442	0.0148
Test critical values:	1% level	-4.200056	
	5% level	-3.175352	
	10% level	-2.728985	

As per the analysis, the Gross TOT is also not stationary at level but stationary at 1st difference.

Here probability value is 0.01, which is lower than 0.05. that's why we reject the null hypothesis and become stationary at 1st difference.

Unit root test of both the variables shows that they are stationary at 1st difference, After the unit root test the Cointegration of the variables checked by Engle–Granger Cointegration and Johnson cointegration. It was found that variables are cointegrated in the long run through Johnson's cointegration. In this situation, we can use the Vector Error Correction Model(VECM).

The vector Error Correction Model restricts the long-run behavior of the endogenous variables to converge to their cointegration relatinship while allowing the short-run adjustments.

Table 5

Vector Error Correction Estimates
Date: 11/20/23 Time: 19:05
Sample (adjusted): 2012 2022
Included observations: 11 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
LGROSSTOT(-1)	1.000000	
LEXCHANGERATE(-1)	-1.961249 (0.43884) [-4.46921]	
C	3.866717	
Error Correction:	**D(LGROS...**	**D(LEXCHANGERATE)**
CointEq1	-0.192281 (0.22772) [-0.84438]	0.120264 (0.02806) [4.28637]
D(LGROSSTOT(-1))	-0.176772 (0.28730) [-0.61529]	-0.063700 (0.03540) [-1.79954]
D(LEXCHANGERATE(...	-2.868910 (1.63942) [-1.74996]	-0.295394 (0.20199) [-1.46240]
C	0.146377 (0.09662) [1.51502]	0.057998 (0.01190) [4.87200]

*(**Source:** Computed by the Author with the help of EViews12 Student Version lite)*

After the analysis of VECM, we found that:

1. The exchange rate is positively impacting the Gross terms of trade in long run. Here Coefficient of the exchange rate says that if there is a 1(one)percent change in the exchange rate, Gross terms of trade will be changed by 2.86 percent. The t- t-statistics suggest that the independent variable that is exchange rate is insignificant during the study period.
2. The coefficient value of Error correction term (ECT) is -0.19. this means that deviation from the long run relationship is corrected at the rate of 19% in present period or annually. This speed of adjustment valid in case of Gross terms of trade is dependent variable and the exchange rate is independent variable.

Causality Tests

Table 6

Granger Causality test explain that when the Gross terms of trade is dependent variable, then

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 11/20/23 Time: 21:08
Sample: 2010 2022
Included observations: 11

Dependent variable: D(LGROSSTOT)

Excluded	Chi-sq	df	Prob.
D(LEXCHANGERATE)	5.108772	1	0.0238
All	5.108772	1	0.0238

Dependent variable: D(LEXCHANGERATE)

Excluded	Chi-sq	df	Prob.
D(LGROSSTOT)	0.792652	1	0.3733
All	0.792652	1	0.3733

Prob. Value is 0.023, which is less than 0.05, here we reject the null hypothesis, eventually the exchange rate causes the Gross TOT, but when the Exchange rate become dependent variable, Gross terms of trade doesn't cause the exchange rate. It means the study shoes the unidirectional relationship between the variables.

As per hypothesis of study, we reject our 1st hypothesis. This study found there is a weak positive correlation between the exchange rate and Gross terms of trade and we accept our 2nd hypothesis, but this impact is not Statistically Significant.

Conclusion

This study explains the relationship exchange rate and Gross terms of trade from 2010 to 2022 India. This paper found that both variables are positively correlated and impact of exchange rate is not significant. This paper also examines there is a unidirectional relationship between the variables. The long run cointegration exists between the variables as indicated by johnson's contegration test. That's why study used the VECM econometrical tools and suggested that the speed of adjustment is 19percent annually.it means error correction terms improve 19 percent every to reach equilibrium position in long run.

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